

CLAIMS

1. Apparatus for generating smoke, comprising:

a smoke producing chamber;

a supply of fluid located within said smoke producing chamber to be vaporized when heated;

5 a heating element located within said smoke producing chamber above said supply of fluid;

a gas inlet communicating with said smoke producing chamber to receive gas under pressure, said gas inlet having an inlet orifice in fluid communication with said supply of fluid so that when gas under pressure is delivered through said gas inlet, some of said supply of fluid is drawn into said gas inlet via said inlet orifice, whereby a mixture of gas and fluid is blown through said gas inlet and against said heating element to be vaporized into smoke when said heating element is heated;

a smoke outlet communicating with said smoke producing chamber to permit said smoke to exit said smoke producing chamber; and

a source of non-flammable gas connected to said gas inlet to supply gas under pressure thereto.

2. The apparatus recited in claim 1, wherein said source of non-flammable gas is a supply of nitrogen gas.

3. The apparatus recited in claim 2, wherein said gas inlet is a tube located within said smoke producing chamber, said gas inlet tube running through and extending above

said supply of fluid to blow a mixture of nitrogen gas and fluid against said heating element.

4. Apparatus to test for leaks in a fluid system, said apparatus comprising:

a smoke producing chamber to generate smoke;

a supply of fluid located within said smoke producing chamber to be vaporized when heated;

5 a heating element located within said smoke producing chamber above said supply of fluid;

an air inlet line communicating with said smoke producing chamber to receive air from a source thereof, said air inlet line lying in communication with said supply of fluid so that when air from the source thereof is delivered through said air inlet line, a mixture of air and fluid is blown against said heating element to be vaporized into smoke when said heating element is heated;

a smoke outlet line extending from said smoke producing chamber to carry the smoke generated by said smoke producing chamber to the fluid system under test; and

means responsive to the pressure in said smoke outlet line to cause said pressure in said smoke outlet line to be discharged to the atmosphere when said pressure exceeds a predetermined pressure level.

5. The apparatus recited in claim 4, wherein said pressure responsive means includes a smoke outlet check valve connected between said smoke outline line and the atmosphere, said smoke outlet check valve adapted to receive therethrough the smoke

generated by said smoke producing chamber to discharge the pressure in said smoke
5 outlet line to the atmosphere when the pressure in said smoke outlet line exceeds said
predetermined level.

6. The apparatus recited in claim 5, wherein said pressure responsive means also
includes a pressure discharge accumulator coupled to said smoke outlet check valve and
communicating with the atmosphere such that the pressure in said smoke outlet line is
discharged to the atmosphere from said pressure discharge accumulator via said smoke
5 outlet check valve, said smoke outlet check valve also adapted to condense the smoke
received therethrough into droplets of said fluid, and said pressure discharge accumulator
collecting the droplets of said fluid that have been condensed by said smoke outlet check
valve.

7. The apparatus recited in claim 4, further comprising:

a source of electrical current to be connected to said heating element within said
smoke producing chamber to supply current to said heating element to cause said heating
element to heat; and

5 a pressure responsive switch connected between said source of electrical current
and said heating element and response to the pressure within said air inlet line,

said pressure response switch adapted to connect said source of electrical current
to said heating element when air is received through said air inlet line and delivered to
said smoke producing chamber, and said pressure responsive switch also adapted to

10 disconnect said source of electrical current from said heating element when no air is received through said air inlet line.

8. The apparatus recited in claim 7, further comprising an air compressor to be connected to said air inlet line to supply air to said smoke producing chamber, and an air inlet check valve connected in said air inlet line between said smoke producing chamber and said air compressor to block the flow of the smoke and fluid from said smoke
5 producing chamber to said air compressor.

9. The apparatus recited in claim 8, further comprising an air flow meter communicating with the fluid system under test and a selector valve connected to said air compressor and having a plurality of valve positions,

said sector valve being placed in a first of said plurality of valve positions to connect said air compressor to said flow meter so that air is delivered from said air
5 compressor to the system under test via said flow meter, and

said selector valve being placed in a second of said plurality of valve positions to connect said air compressor to said air inlet line so that air is delivered from said air compressor to said smoke producing chamber via said air inlet line and said air inlet
10 check valve connected therein.

10. The apparatus recited in claim 9, further comprising an air accumulator having an air pressure relief check valve coupled thereto, said air accumulator connected between said selector valve and said air flow meter to reduce fluctuations in the air delivered to

said flow meter from said air compressor, said selector valve being placed in a third of
5 said plurality of valve positions so that said air inlet line between said air inlet check
valve and said selector valve is simultaneously connected to said air compressor and to
the pressure relief check valve of said air accumulator.

11. Apparatus to test for leaks in a fluid system, said apparatus comprising:

a multi-position selector valve;

a source of gas under pressure connected to said multi-position selector valve;

a gas flow meter communicating with the fluid system under test;

5 means for generating smoke to produce smoke to be delivered to the fluid system
under test;

a first gas inlet line connected between said multi-position selector valve and said
means for generating smoke;

10 a smoke outlet line connected to said means for generating smoke to deliver the
smoke produced by said smoke generating means to the fluid system under test; and

a second gas inlet line connected between said multi-position selector valve and
said gas flow meter,

said multi-position selector valve being placed in a first position to connect said
source of gas under pressure to said second gas inlet line so that gas under pressure is
15 delivered to the fluid system under test via said gas flow meter, and said multi-position
selector valve being placed in a second position to connect said source of gas under
pressure to said first gas inlet line so that gas under pressure is delivered to said smoke
generating means.

12. The apparatus recited in claim 11, wherein said source of gas under pressure is a supply of nitrogen gas.

13. The apparatus recited in claim 11, wherein said source of gas under pressure is a supply of air.

14. The apparatus recited in claim 11, further comprising means responsive to the pressure in said smoke outlet line to cause said pressure to be discharged to the atmosphere when said pressure exceeds a predetermined pressure level.

15. The apparatus recited in claim 14, wherein said pressure responsive means includes a pressure discharge accumulator communicating with the atmosphere and a smoke outlet check valve connected between said smoke outlet line and said pressure discharge accumulator, said smoke outlet check valve adapted to discharge the pressure in said smoke output line to the atmosphere via said pressure discharge accumulator when the pressure exceeds said predetermined pressure level.

16. The apparatus recited in claim 11, further comprising a source of electrical current to be connected to said smoke generating means to supply current to said smoke generating means in order to produce smoke and a pressure responsive switch connected between said source of electrical current and said smoke generating means and responsive to the pressure within said first gas inlet line, said pressure responsive switch

adapted to connect and disconnect said source of electrical current to said smoke generating means depending upon the pressure within said first gas inlet line.

17. The apparatus recited in claim 11, further comprising a gas pressure relief check valve connected between said second gas inlet line and the atmosphere and responsive to the pressure within said second gas inlet line to cause said pressure within said second gas inlet line to be discharged to the atmosphere when said pressure exceeds a
5 predetermined pressure level.

18. The apparatus recited in claim 11, wherein said multi-position selector valve is placed in a third position to simultaneously connect said first gas inlet line to said second gas inlet line and to said source of gas under pressure.